

CONCRETE PAVEMENTS FOR SMALL URBAN STREETS

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INTRODUCTION

Although the title indicates only urban areas, the presentation should and will encompass rural areas as well. The word "small" probably should be replaced with the term "low volume" streets and highways. Some of the best examples of the qualities and serviceability of concrete pavements are the 50 and 60 year old municipal and state highways. In addition, many of the ideas presented here are applicable to the high volume and heavy loads carried by interstate pavements.

But, the presentation will concentrate on low volume streets and highways. These generally are found in all systems. In smaller governmental agencies, small municipalities, counties and townships, these streets and highways are of prime concern. They are in many instances their high volume and provide the officials with their greatest challenges.

TODAY'S ECONOMY

The economic and political environment in which we work today is one of squeeze, squeeze, squeeze, pressure, pressure; more services for the dollar; more services with less people; reduce costs; eliminate the non-essential. Simultaneously, the lackluster economy makes our taxpayers unhappy. They will blame economic problems on anyone they can - especially government officials! And yet, in the same breath, they want more services!

That pressure is from outside. From your side, as a transportation officer, the infrastructure is deteriorating, some is giving out; maintenance is eating you alive and there is little left for infrastructure replacement. Anxiously, we turn to maintenance and rehabilitation hoping to get a full dollars worth of service for a few more years.

SOLUTIONS

As Chairman of the American Society of Civil Engineers, Local Roads & Streets Committee, one of the issues that arises constantly is: We need a low cost (cheap) method of rehabilitating, and/or replacing a low volume street or highway without additional right-of-way, and without interrupting traffic. The method has to have the credentials and backing of professionals to assure engineering legitimacy, safety and minimize or eliminate liability (law suits). Talk about Utopia - but if you have some suggestions, we welcome you to join our committee.

Seriously - we need to get back to basics. Do things well, when we do them. There is an old adage. "Take care of the little things and the big things will take care of themselves." We talk of maintenance management systems. And they're excellent. Many of these are complicated and beyond the scope and capability of many of our smaller governmental units. But the concepts are good and they can be adapted to your system. In one sense its easier. Your system is generally smaller and may not be as diverse.

Example - as a young county engineer, I had a 750 mile road system - all gravel or stone

surfaced. We were still getting people out of the mud in the early 50's, by grading and surfacing the roads. Many farm houses were close to the road and wanted to extend their nicely mowed lawns to the edge of the surfacing - that meant little or no ditch. That also meant little or no drainage. We had our own trucks for spotting gravel at weak or thin surfaced areas. By noting where these spots occurred (where we placed the most gravel) it soon became evident that these "little or no drainage" areas were requiring an inordinate amount of aggregate. We talked with farm groups and demonstrated to them the results of our records. From that point on we did not always get a full ditch in front of houses but we got enough for drainage. We also went out and corrected some old ones. Records and attention to details can help! There is an advertisement for Ektar film which is appropriate here "The genius is in the details". Reducing future maintenance was the important result. That is something we need to do today. We believe concrete, portland cement concrete, can provide that "something."

PORTLAND CEMENT CONCRETE

There have been more new and approved initiatives in concrete in the last five years than any surfacing material. It has been and is on the frontier, the cutting edge of change and improvement in pavements.

Lets take a look at some of the new initiatives that offer immediate alternatives for pavement managers. And alternatives is what we as managers are looking for. No street or highway system is the same, each situation is unique, each requires an analysis of alternatives using good engineering judgment based on known hard facts.

1. White topping - concrete overlays of asphalt pavements. There is no need for correction or irregularities of the surface. Just fill potholes with compacted aggregates. The possible extra crown provides for a pavement with thickened edges. That's exactly what was used in early concrete pavements. Depending on traffic, a minimum 3 1/2" to 4" at the center line will assure adequate depth and enable filling of traffic ruts and irregularities. Iowa counties have been using this technique for several years. I observed a road leading to a grain elevator with a 4 inch overlay. It is performing well. When the truck hits the road, concrete will take the load.

2. Overlays - Overlaying concrete pavements, either bonded or unbonded, is another alternative. Though you may not have the older concrete pavements (some municipalities do) we're discussing here, the concepts have been so perfected that it cannot be overlooked.

3. Fast track - the Iowa 1986 experiment has become an often used alternative; in fact, a must in many instances. It is especially useful and needed in critical traffic situations where quickness is needed. The City of Glen Ellyn, Illinois wrote it into their specifications and use it consistently. Pavements reach their desired strength for traffic within 24 hours. Further improvement of techniques have permitted us to gain adequate strength in 18 and even 12 hours.

4. Quick patch - The Iowa project spawned additional innovation. Now there is a patching material which will set in four hours.

5. High strength - we used to think 6000 psi concrete was high strength. Today 10,000, 12,000, 15,000 psi and more are being used regularly. Will that effect you - yes. It provides a dense more moisture proof material that has everyday application in bridges, buildings and tomorrow in pavements.

6. There are other innovations in cements, use of additives, and fibers in concrete

that provide great opportunities for specific applications. With that array of innovation we cannot afford to think in traditional ways. And one of the attributes of local agencies I've learned over nearly 50 years working with them is they are innovative, non-traditional thinkers. They have had to be just to survive.

ATTRIBUTES OF CONCRETE

Lets take a look at some of the characteristics of concrete. It is a conglomerate of aggregates, sometimes fly ash and water held together with a glue called cement. We can use additives to help resist reaction to chemicals, to increase flowability, yet keep the high strength water-cement ratio, or to delay or quicken the hardening process. It is rigid, not flexible. And we can guarantee it will crack! We want and can control where it cracks.

It really is simple to design. There are excellent aids that can be used by engineers using their good judgment published by Portland Cement Association (PCA)(1), American Concrete Pavement Association (ACPA)(2) and the American Concrete Institute (ACI)(3), and reprinted by the National Ready Mixed Concrete Association (NRMCA). These are comprehensive manuals which guide the designer through the design process. Obtaining the correct and adequate traffic data may be more of a problem than the design itself.

Concrete pavements are durable. This year Ohio celebrated a Portland Cement concrete pavement's 100 year anniversary.(4) My home town of Springfield, Illinois has streets approaching 70 years old. Concrete pavements are designed for 20 years, using an anticipated traffic. Most of the Illinois interstate concrete pavements survived the 20 years carrying 2-3 times the design traffic. There is little need for weight limitations or restrictions. And concrete increases strength with age. Concrete pavements are competitive in cost when designs are equal. And in urban areas where lighting is an issue, up to 40% less lighting standards are necessary for required lighting. (5) That in turn requires less energy for every year over the life of the pavement. Ready mix operators are available in most small communities making availability a plus. And since they live and operate in the community they want quality too. Maintenance of concrete is minimal. It has low annual cost as borne out by the Kansas Municipal study (6) and the Iowa County study (7). Repairs are simple but seldom needed.

Concrete pavements provide a safe surface with built in skid resistance, drainage is positive and its reflectance is excellent for lighting purposes. Adding an integral curb or tied shoulder will add the same strength as an additional inch of pavement thickness. And a rule of thumb is if you thicken the pavement by one inch you double the lifetime load carrying capacity. Thus, if six inches will carry 100 2 axle trucks per day, a seven inch will carry 200 2 axle trucks per day.

There is no need for reinforcement. Reinforcement does not strengthen concrete, but is used to hold together fractured or cracked pavement.

APPLICATION

As mentioned earlier, the roads or streets you are concerned about are your major, heavily traveled ones. Or perhaps a major intersection is proving to be a headache in maintaining it to satisfactory level within a limited budget.

Roads or streets leading to grain elevators, a truck stop or some other transfer station are

ideal candidates for concrete pavement. I offer examples of two communities in Illinois one with population of 1600, the other 3200. The first had a grain elevator on a major street. Concrete was the answer. They're so satisfied now they're thinking of more concrete streets which they didn't think they could afford. The second had an intersection problem quickly and efficiently solved through the use of concrete pavement. They didn't use the fast track, quick set method, but it is an alternative to be considered if business and traffic are to be interrupted significantly.

A new innovation is "flex-crete". A two inch fiber reinforced overlay. In many communities, streets have been resurfaced to a point where curbs have lost their drainage capacity, crowns have become excessive. What now? Cold milling is the only solution. And then we start all over again. Concrete flex-crete is an alternative. If necessary, it too can be recycled. These are not all of the applications but with your inquisitive and innovative minds, I'm sure the ideas, facts and suggestions presented here will spawn applications in your system.

Recently, an economic analyst looked at the spending practices in one state during the last twenty years and noted the erosion of priorities for adequate education, health and highways. He stated these three items are a state's basic infrastructure that an economy is built upon. They cannot be overlooked or slighted if we're looking for economic survival and future development.

You are in a very important position in assuring your community and state of the basic infrastructure upon which the economy and development is made.

You're in the drivers seat. You must not only look to today's solution, but realize the impact of your decisions on tomorrow. Concrete can make the difference. Although you may argue, "I've not done that before", there are plenty of people who have. Use them. Gaining knowledge is the cheapest and most fun part of the game.

You need to lay a solid foundation for the future of your street or highway system. Concrete can be that foundation. Look for alternatives and expand your imagination, that is a part of your survival kit.

REFERENCES

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